A STUDY OF SIMULTANEOUS CONTRAST COLOR IMAGES.[1]

By Charles A. Oliver, A.M., M.D.,
OF PHILADELPHIA, PENNA., U. S. A.

In December of 1901, while spending a number of most interesting and instructive evenings with Dr. S. Weir Mitchell, of this city, he called my attention to some curious visual phenomena which he had observed while gazing at some of the cascades in Japan; these phenomena consisted of a series of isolated, foam-like, and rapidly descending masses, showing a color display of brilliantly tinted lines, which fell and broke at corresponding depths with all the glow of prismatic scintillations.

We having determined from his individual knowledge that the conditions of the direct and the indirect natural illumination under which he had made his observations did not differ with the character of the light, except as to the degree of vividity and the peculiarities of color change, and, I being informed of the exact state of his rather rare form of antimetropia, opportunity was thus offered me to devise on these premises a number of apparatuses with which we experimented. Our results being so interesting, we repeated the studies in divers ways upon a number of scientific friends and acquaintances.

Through the kindness of a well-known firm of opticians in this city, a number of specially formed contrivances were constructed, which opened a new field of curious and unexpected results.

The experiments, which were conducted upon educated and observing men and women who possessed either normal uncorrected vision or normally corrected vision, all were made under similar though not identical conditions, which were noted in each instance. Nothing was suggested in any way to the subject, and everyone was allowed to express his sensations in his own way, by speech, writing, or drawing. Everything was voluntarily obtained; one eye was experimented upon at a time; the distance chosen for the testing was that which practically represented infinity; the apparatus employed was always placed in as near a true position for normal color reflection as was possible, and the time of day and the character and condition of the illuminants were considered in every case. All relevant facts were noted.

In two years from the time of the inception of the plan more than 1000 experiments were conducted upon some 600 subjects. Most of the trials were made by using rapidly moving bands of black and white. Control tests were made upon a number of subjects possessing known degrees, both of congenital and acquired subnormal color perception.

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[1] Read before the Section on Ophthalmology of the College of Physicians of Philadelphia.

After the performance of all of these experiments, methodical search was made throughout a large number of articles, monographs, and books upon the physiology of color, in order to find whether subjective contrast colors had ever been evolved in the same manner as that in which it had now been accomplished, and whether similar reasons had been deduced for the appearance of the phenomena.

With the exception of Francis Hopkinson's "Optical Problem Proposed to Mr. Rittenhouse and Solved by Him" in this city in the year 1785; Moigno's remarkably interesting and similar experiments; the unexplained results of the evolution of color fringes in Pear's (Barrett's) top of graded black and white concentric bands, and Bidwell's color phenomena, and the crude notes of such results in some of the ophthalmic text-books, several special monographs and journal articles, and the most interesting paper of Rivers "On Erythropsia," nothing was found which could be considered as more than explanatory of some pet theory or a conclusion drawn from doubtful premises.

The data obtained are summarized in the following statements:

1. Simultaneous color contrasts may be obtained through healthy visual apparatuses by the sudden repetition of imperfectly perceived areas of white.

2. The first contrasts noticed from fixed forms of white on black consist in constantly changing and irregularly grouped areas of uncertain "salmon reds," which assume varying tints dependent upon the shape, the degree of movement, and the relative sizes of the moving objects.

3. The secondary contrasts are fully complementary in values to the primary subjective "reddish" colorations, and consist of evanescent green borders, flecks, and bands, which appear alongside of the white objects, in front of the red subjectivisms, and on deeper and apparently farther-removed planes of vision.

4. When the objective "whites and blacks" are more ephemerally perceived, both the "red" and "green" subjectives appear simultaneously in connective bands, stripes, arrows, wedges, and all manner of anomalous forms, dependent upon the shape of the objects exposed, the rapidity of their movements, and the character of the individual visual apparatus.

5. All of these subjective manifestations are preceded by a brief impression of grayish or smoky areas, varying in intensity and momentarily projected and depressed.

6. In many cases, after and even during the appearance of the green-red complements, numerous blue-yellow tints appear in definite complementary relationships, some especially in the peripheral portions of the field.

7. Many of the higher-grade observers reported a number of the secondary and even tertiary color combinations which were usually seen as fleeting spots and stripes, these results obtained in addition to the phenomena of the ordinary color fatigue compressions.

8. Cases of subnormal color perception reduced in the ordinarily understood recognition of green, failed to evolve any properly tinted "green," as was shown by having these subjects select the tints they had seen from carefully chosen color-test wools. Neither did these cases obtain subjective expressions of the complement "red."

9. Cases of subnormal color perception lowered beyond that of the ordinary recognition of green and red, invariably reported "misty appearances," "grayish clouds," etc., followed by blue-yellow complements, but never noted any "green" and "red."

OBSERVATIONS OF A CASE OF BITEMPORAL HEMIANOPSIA WITH SOME UNUSUAL CHANGES IN THE VISUAL FIELDS.[1]

By Clarence A. Veasey, M.D.,
OF PHILADELPHIA,
OPHTHALMIC SURGEON TO THE METHODIST EPISCOPAL HOSPITAL; ASSISTANT OPHTHALMIC SURGEON AND CHIEF OF CLINIC TO THE JEFFERSON MEDICAL COLLEGE HOSPITAL, ETC.

The following case of bitemporal hemianopsia has seemed to the writer to present some unusual features of sufficient interest to merit its isolated report.

G. P. S., a married travelling salesman, aged thirty-four years, consulted me first on May 27, 1903, and presented the following history: His general health had always been excellent, and his appearance so indicated, as he was about six feet in height and weighed about 170 pounds. There was no history of any ocular trouble in his family, and though he began to wear glasses at sixteen years of age, for a low compound hyperopic astigmatism, his eyes had given him no trouble except the headaches which the glasses had corrected. Early in January, or six months before I first saw him, there had gradually appeared a "fogginess" of the temporal half of each field of vision, which he thinks was noticeable in the right eye before it was observed in the left. He placed himself under the care of a homœopathic oculist, who gave him as much as 50 grains of iodide of potassium three times a day, and this dose he had been taking for some months. Specific history was denied, and there were no other symptoms to cause its presence to be suspected. The urinary and blood examinations were negative.

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[1] Read at the Fortieth Annual Meeting of the American Ophthalmological Society, July, 1904.